



ISO 9001:2008

CONOTEC®

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CONOTEC CO., LTD.

User Manual

FOX-P100



- ◆ PID temperature controller
- ◆ Relay /SSR PID, Current PID control
- ◆ RS485 (MODBUS-RTU) support
- ◆ NTC10K / CA(K) / PT100 sensor selectable
- ◆ 3 kinds of sensor mounted by auto tuning only once

※ FOX-P100 is a controller that can perform PID function for PID, SSR PID, 4 ~ 20mA current and can select a sensor from menu among three types of NTC10K / PT100 / CA (K).

※ Thank you for purchasing the Conotec products.

This manual is for the user to prevent damage or malfunction caused by negligence. Please keep it with you to refer to when you have any question and read the precautions carefully before use for proper use.

Regarding the English - language manual, please download it at our homepage

1 Model compositions

Model	Input	Output	Communication	Input power
FOX-P100	NTC10K PT100 CA(K)	Relay 1 SSR /Current 1	RS485 Modbus RTU	AC100V ~230V 50/60Hz

* NTC10K 3M is included as standard but, (PT100, CA(K) sensor not included.

2 Safety for caution

Please read the precautions before use to use properly well.

※ The specifications contained in this manual, dimensions are subject to change without notice for improvement of product performance.

Warning

- As the product is not manufactured as safety equipment, make sure to use this product after mounting double safety device when using it for the purpose of controlling a device having risk of personal injury, equipment damage or huge property loss.
- Do not cut the wire or make check-up or maintenance when the power supply is connected.
- Make sure to check the socket number before connecting the power.
- Never disassemble process, improve or repair this equipment.

Cautions

- Please read carefully about how to use, safety regulations, and warning prior to install this device and must use within defined relevant specification or relevant capacity.
- Do not make wiring or installing in the big motor has a big inductive load and solenoid.
- Please use shielding wire at the sensor extension and do not make it unnecessarily long.
- Do not use the parts that generate the arc at same power or near directly opening and closing.
- Power line should be kept away from high-voltage line and do not install in the watery, oily, and dusty place.
- Do not install this device in a place exposed to direct sunlight or rain.
- Do not install this device in a place with strong magnetism, noise, vibration, and shock.
- Keep away from the place where strong alkali and acidic substances are detected and use an independent plumbing.
- Do not spray water directly for the purpose of cleaning at installing it in the kitchen.
- Do not install in a place that temperature/ humidity exceeds the rating.
- Use it without disconnecting the sensor line or scratching.
- Sensor line should be kept away signal, power, and load lines, and use an independent piping.
- Please note that this product is not follow-up managed at disassemble or remodeling at your discretion.
- The signal of displayed in the terminal wiring diagram is the safety statement of warning or caution.
- Do not use near where devices generate strong high-frequency noise (high-frequency welders, high-frequency sewing machine, high frequency radios, large SCR controller).
- If you use this device beyond the method specified by the manufacturer, it may cause injury or property damage.
- Keep out of reach of children as this device is not a toy.
- The device only be installed by relevant specialist or qualified worker.
- The company will not accept any liability in respect of such cases that customer does not comply with the warning or caution wording stated in the above or damages caused by negligence of the customer.

Danger

Caution, Danger of Electric Shock

- Electric shock - Do not contact AC terminal during the current carrying. Electric shock can occur.
- In case of checking the input power, it should be disconnected

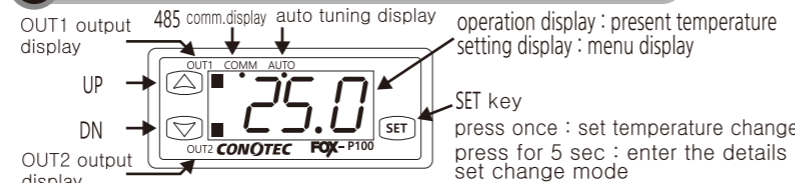
3 Main features

- * PT100Ω, CA(K), NTC10K 3 kinds of sensor selectable
- * Control of relay PID, SSR PID, current PID* RS485 MODUB RTU available
- * Function to transfer 4 ~ 20mA PV * Uncomplicated entry-level PID controller

4 Specifications

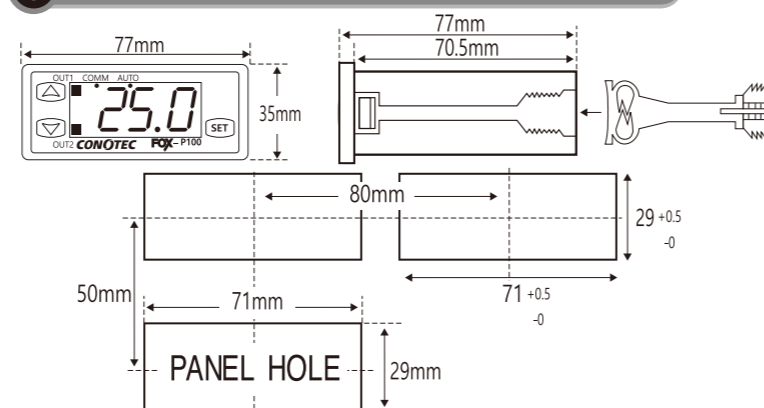
Input power	100~240VAC 50/60Hz	Consumption power	
Display	7segment 3.5Digit 0.51Inch	Weight	130g
Sensor type	PT100, CA(K), NTC10K		
Display accuracy	PT100, NTC10K : ±1% rdg ± 1 digit CA(K) : ±1% rdg ± 1 digit		
Output specifications	Out1(relay) : ON/OFF output or alarm output or PID control (250Vac 2A Max, 1a relay) Out2(SSR/current) : SSR PID or current PID or PV transmit (Current : resistive load within 500 ohm, SSR 11VDC±2V within 20mA)		
Communication specifications	RS485, Modbus RTU, Data 8bit / ParityNone / Stop 1		
Proportional band width(P)	PT100,NTC10K : 0~100.0°C	integral time (I)	0~1999sec
	CA(K) : 0~100°C	derivative time (D)	0~1999sec
Normal state error correction	PT100,NTC10K : -100.0~100.0°C	control cycle(T)	0~120 sec
	CA(K) : -100~100°C	Memory term	about 10 years(non-volatile)
Ambient	0~55°C, 35~80%Rh(no freezing or dew condensation)		

5 Front panel and display part names

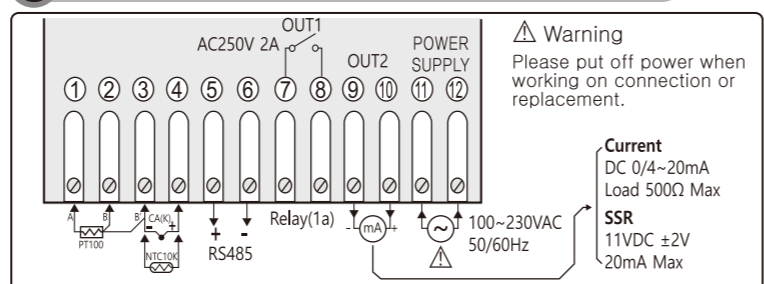


In case of SSR Output: Output ON - LED on, output off -LED off
In case of current PID: blink according to the size of the control variable

6 External and panel cutout dimensions



7 Terminal wiring diagram



8 Logo at the power input

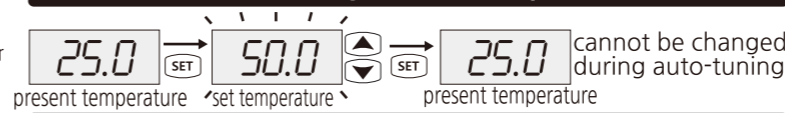


Please check input power when product logo is continuously displayed as it indicates that power supply is unstable.

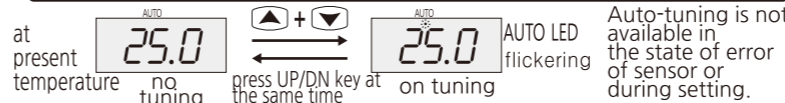
Warning. Unstable power supply can lead to damage of the internal memory.

9 How to set the program

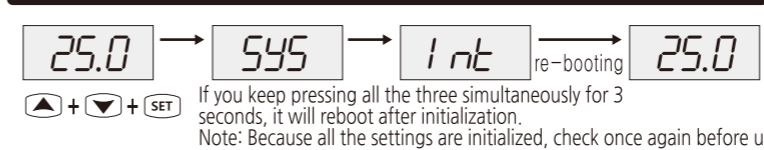
How to change the set temperature



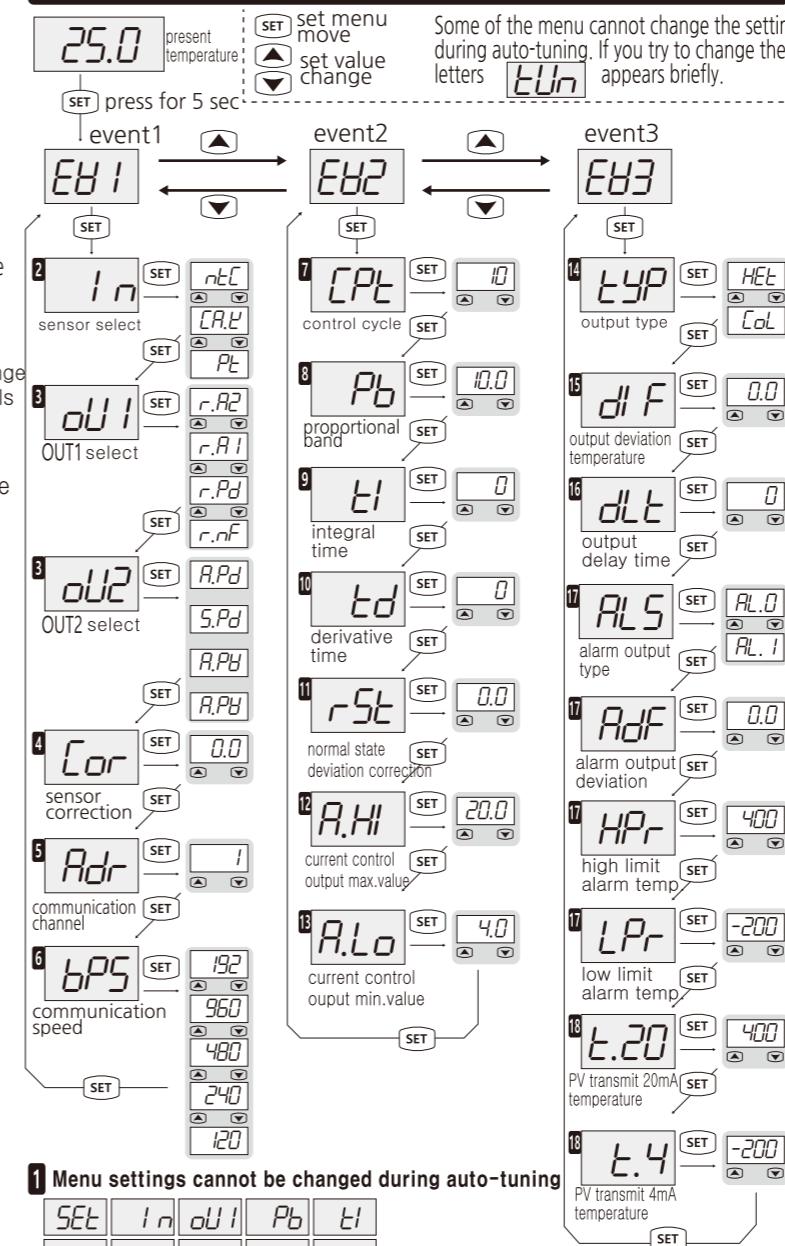
Auto-tuning start/stop



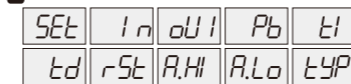
Initialize the set value



Program setting



1 Menu settings cannot be changed during auto-tuning



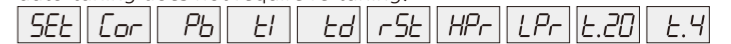
To change your settings, press keys simultaneously to turn off auto tuning before change.

When you try to change the value of the top menu during auto-tuning, letters appears briefly.

2 In sensor selection

- ntC NTC10K ohm CONOTEC model no. FS-200N), -55.0~99.9°C
- CA.P K thermocouple sensor, -50 ~ 1200 °C
- PT RTD PT100 ohm, -199 ~ 400 °C

Menu below is stored in a separate memory space according to the sensor type, and PB, TI, TD is automatically saved to suit different sensors with one sensor tuning. In other words, changing the sensor after the completion of auto-tuning does not require re-tuning.



However, if you want a precise auto-tuning to fit the sensor, you may do re-tuning after selecting the desired sensor.

3 OUT1 selection

△ Note: OUT2 output is selected automatically by selecting OUT1 output.

OUT1 : Relay output	OUT2 : SSR or current output
r.P2	A.Pd
r.A1	S.Pd
r.Pd	A.PH
r.nF	A.PH

4~20mA current PID control
SSR PID control
4~20mA current PV transmit

4 Cor Sensor correction

When there is a difference between the present temperature displayed and the temperature measured by precision instruments, you may match the displayed value to the actual measured temperature.

Example 1) Display Value: 5 degrees, the actual measured temperature: 10 degrees => input COR +5 degree

Example 2) Display Value: 5 degrees, the actual measured temperature: 2 degrees => input COR -3 degree

5 Adr RS485 communication address

It is a menu to align an address with upper system for RS485 communication.

Example) If the FOX-P100 address of the PC program is set to 3, the ADR menu should meet 3.

6 bPS RS485 communication speed

This is a menu to align communication speed to match an upper system for RS485 communication.

Example) If the communication speed of the PC program is set to 9600BPS, BPS menu should meet 960.

120: 1200BPS, 240: 2400BPS, 480: 4800BPS, 960: 9600BPS, 192: 19200BPS

7 CPE Control cycle

When implementing PID control / P control / PI control, etc. using a relay or SSR output, ON and Off are repeated within a set time cycle, which is called as a control cycle.

△ Note: When performing PID control by relay, if the control cycle is too short, life of the relay contact may be shorten with frequent ON/OFF.

8 Pb Proportional Band

If current temperature is within proportional band width, control by adjusting the rate of ON/OFF in CPT.

9 TI Integration time

Integration time means the time for obtaining the same manipulated variable with proportional operation with only integral action. Proportional operation alone cannot reach the target temperature, and temperature deviation occurs. Integral action ensures that the current temperature reaches the target temperature adding integrated deviation.

- * If the integral time is too short: regular vibrations may occur.
- * If the integration time is too long: difficult to reach the target temperature or takes long time.
- * If integral time is 0, integral action does not work.

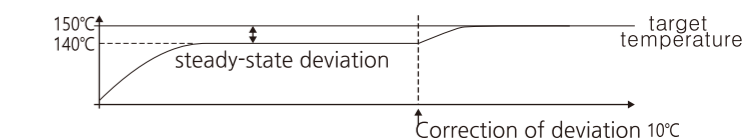
10 Td Time proportional integral derivative time

Derivative time is the time from when the deviation is proportional action only get the amount of operation such as differential behavior when changing constantly. D action by monitoring a variation of the disturbance takes place rapidly, when the difference between the previous deviation of the operation amount is large, added much to quickly respond to the disturbance.

- * If the derivative time is too short: late response to disturbance.
- * If the derivative time is too long: regular vibration may occur.
- * If the differential time is 0, no derivative action.

11 rSt Correction of deviation in a steady-state

Applicable when using P action only. P action alone cannot reach target temperature and will have a steady-state deviation. Deviation can be corrected using RST menu.



12 A.HI Maximum output of current control

Current output value of 100% operation when operating PID control with current output.

Example) A.HI = 15.0mA is the current output value at 100% operation, current output 15.0mA,

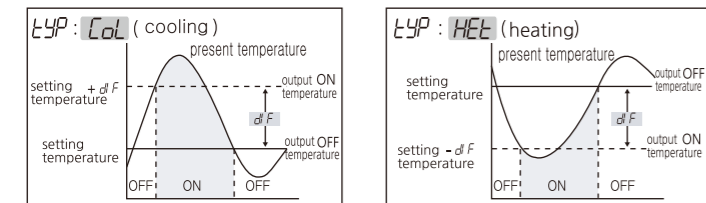
13 **A.L.O** Current control output minimum value
 This will be the current output value if the manipulated variable is 0% and it's the case of operation such as PID control etc., as the current output For example) A.LO = 10.0mA If the current output of 10.0mA when the manipulated variable of 0%

14 **EYP** Output type
 Heater : **HEL** setting Cooler : **COL** setting

15 **dF** Output deviation temperature setting

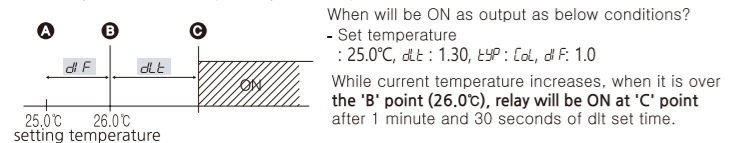
* Direction of deviation: one direction (+ direction). * Output OFF at setpoint

When the relay output is repeated too frequent ON / OFF, output contacts are quickly damaged or hunting by external noise (oscillation, chattering) occurs. It is a function to protect contact of the device by setting a regular intervals between ON and OFF to avoid such phenomina.



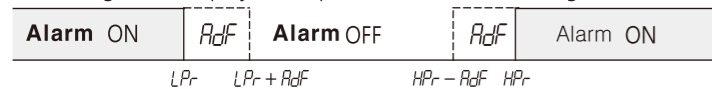
16 **dLT** Set Output Delay Time

If a problem occurs frequently repeating ON/OFF operation, it functions to protect the device from momentary power failure or power resumption (chillers, compressors, etc.)



17 **RLS** Alarm output type setting **RdF** Alarm output deviation temperature **HPr** Alarm output high limit temperature setting **LPr** Alarm output low limit temperature setting

RLD : Alarm output type when out of the range alarming when displayed temperature is out of the range



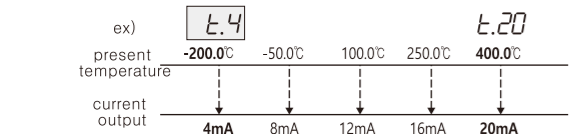
RLI : Alarm output type when within the range alarming when displayed temperature is within the range



18 **E.20** Temperature setting that corresponds to 20mA current output in PV transmission output. **E.4** Temperature setting that corresponds to 4mA current output in PV transmission output.

To send the present temperature to the current output, by dividing the set temperature range at T20 and T4 and output as 4~20mA.

Output a current corresponding to the temperature change by 0.1 degrees.



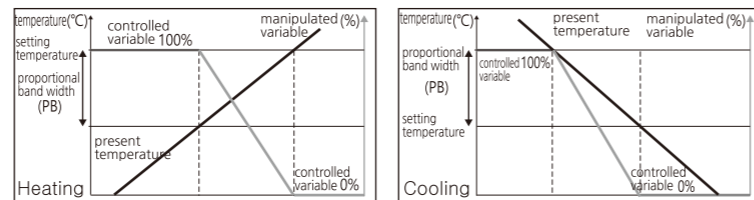
10 Control output

1 Relay OnOff control

If set **OUT1** as **r.nF**, **OUT1** : relay On/OFF output
OUT2 : **4~20mA** to be set as current output
 Refer and set **EYP** output type **dF** output deviation temperature **dLT** output delay time, etc.,

2 P control

Output type	Setting & using terminal number
Relay P control	Set as OUT1:r.Pd , OUT2:Pv , using terminal No. 7, 8 OUT1:relay P control, OUT2:Pv transmit ouput
SSR P control	Set as OUT1:r.P1 , using terminal No. 9, 10 OUT1: alarm output, OUT2:SSR P control
Current P control	Set as OUT1:r.P2 , using terminal No. 9, 10 OUT1: alarm output, OUT2: Current P control



P control alone cannot have the current temperature reach the set temperature and leaves residual variance. This is called steady-state error, which can be corrected using the RST (steady-state error compensation) menu.

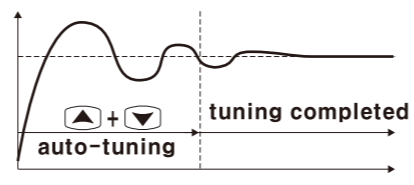
3 PID control

Output type	Setting and using terminal number
Relay PID control	OUT1 : set as r.Pd , terminal using no. 7, 8 OUT1:relay PID control, OUT2:Pv transmit
SSR PID control	OUT1 : set as r.P1 , terminal using no. 9, 10 OUT1:alarm output, OUT2:SSR PID control
Current PID control	OUT1 : set as r.P2 , terminal using no. 9, 10 OUT1:alarm output, OUT2:current PID control

PID control calculates optimum coefficient through the auto-tuning and allows you to effectively maintain the target temperature.

Auto tuning

After two or three times on and off in the vicinity of the set temperature, complete tuning. Even if the sensor is changed, it is not necessary to re-tune existing one.



Control cycle



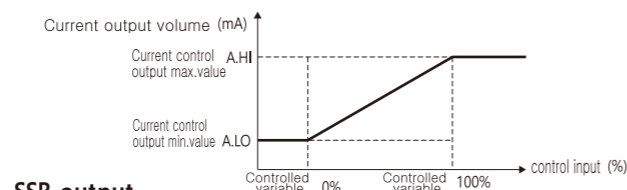
* Relay PID and SSR PID control operate in the format of dividing control cycle into on and off section as a percentage.

* Minimum on and off times in case of Relay PID control:
 when CPT is less than 5 seconds: 0.3 seconds
 less than 10 seconds: 0.5 second
 more than 10 seconds: 1 second

* **Minimum on and off time at SSR PID control is 0.05 seconds unconditionally(50ms).**

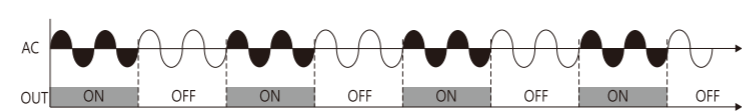
Note: When performing PID control by relay, if the control cycle is too short, life of the relay contact may be shorten with frequent ON/OFF.

* Current PID Control controls in a continuous output regardless of the control period (CPT)



SSR output

* SSR output is OnOff type output same as relay output and the ratio of On and Off varies depending on the controlled variable.



* SSR output may use No. 9 & 10 current output terminal.

11 Communication output

- * RS485 MODBUS RTU type of protocol is built-in.
- * 2-wire half-duplex asynchronous communication system
- * Working distance: within 1.2Km
- * Communication speed : 1200 / 2400 / 4800 / 9600 / 19200BPS
- * Start bit : 1 bit, stop bit : 1 bit, Parity bit : None, Data bit : 8 bit

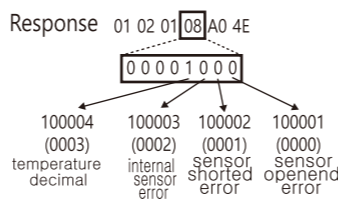
Modbus Mapping Table

< Func 0x02 : Read Discrete Inputs > You can receive a brief information in the for of bits, such as a sensor status and a decimal.

Sub products address	command	start address	number of data	CRC16
1BYTE	0x02	high byte	low byte	low byte
		high byte	low byte	high byte

Request 01 02 00 00 00 04 79 C9

Sub products address	command	number of data	data	CRC16
1BYTE	0x02	1BYTE	1BYTE	1BYTE



MAP

NO	Address	Description	Range	Unit	Value at shipment
100001	0000	sensor open error	bit0 0: No error, 1: open error		
100002	0001	sensor short error	bit1 0: No error, 1: sensor error		
100003	0002	internal sensor error	bit2 0: No error, 1: sensor error		
100004	0003	temperature decimal point	bit3 0:None, 1:1 decimal point		

< Func 0x04 : Read Input Registers > You can receive brief information such as Commands, Start address, Number of data, Temperature, Decimal, Current temperature, status of the sensor and decimal.

Sub products address	command	start address	DATA numbers	CRC16
1BYTE	0x04	high byte	low byte	low byte
		high byte	low byte	high byte

Sub products address	command	Byte numbers	DATA 1	DATA n	CRC16
1BYTE	0x04	1BYTE	low byte	high byte	low byte
			low byte	high byte	high byte

MAP

NO	Address	Description	Range	Unit	Value at shipment
300001	0000	present temperature	at a sensor error : -5000	°C	
300002	0001	sensor open error	bit0 0: no error, 1: open error		
		sensor short error	bit1 0: no error, 1: short error		
		internal sensor error	bit2 0: no error, 1: sensor error		
		temperature decimal point	bit3 0:none, 1: has a decimal point		

Sub products address	command	numbers of data	CRC16
1BYTE	0x03	low byte	low byte
		low byte	high byte

< Func 0x03 : Read Holding Registers > Able to read the set value

Sub products address	command	start address	DATA	CRC16
1BYTE	0x03	high byte	low byte	low byte
		high byte	low byte	high byte

Sub products address	command	numbers of byte	DATA 1	DATA n	CRC16
1BYTE	0x03	1BYTE	low byte	high byte	low byte
			low byte	high byte	high byte

< Func 0x06 : Write Single Register > You can change the setting one by one.

Sub products address	command	writing address	DATA	CRC16
1BYTE	0x06	high byte	low byte	low byte
		high byte	low byte	high byte

Sub products address	command	writing address	DATA	CRC16
1BYTE	0x06	high byte	low byte	low byte
		high byte	low byte	high byte

< Func 0x10 : Write Multiple Registers > Several items of the setting values can be changed at a time.

Sub products address	command	start address	DATA	DATA 1	DATA n	CRC16
1BYTE	0x10	low byte	low byte	low byte	low byte	low byte
		low byte	low byte	low byte	low byte	high byte

Sub products address	command	start address	numbers of data	CRC16
1BYTE	0x10	high byte	low byte	low byte
		high byte	low byte	high byte

MAP Func 0x03, 0x06, 0x10

NO	Address	Menu	Description	Range	Unit	Value at shipment
400001	0000	IN	Sensor selection	0:PT100, 1:CA(K), 2:NTC10K		2:NTC10K
400002	0001	OUT	Output type	0- Out1: on/off, Out2: PV transmit 1- Out1: RelayPid, Out2: PV 2- Out1: Alarm, Out2: SSR PID 3- Out1: Alarm, Out2: Current PID		0: - Out1: On/OFF output - Out2: PV transfer output
			setting temperature	PT100 : -200 ~ 400°C CA(K) : -50 ~ 1200°C NTC10K : -55.0 ~ 99.9°C	°C	0
			sensor correction of error	PT100 / NTC10K : -19.9 ~ 19.9°C CA(K) : -19 ~ 19°C	°C	0
400003	0002	SET	RS485 address	1 ~ 99		1

NO	Address	Menu	Description	Range	Unit	Value at shipment
400006	0005	BPS	RS485 speed	1200 / 2400 / 4800 / 9600 / 19200	BPS	9600
400007	0006	CPT	control cycle	1 ~ 120	sec	20
400008	0007	PB	proportional band	PT100 / NTC10K : 0 ~ 100.0°C CA(K) : 0 ~ 100°C	°C	PT100 / NTC10K : 10.0 CA(K) : 10
400009	0008	TI	integral time	0 ~ 1999	sec	0
400010	0009	TD	derivative time	0 ~ 1999	sec	0
400011	000A	RST	steady-state error correction	PT100 / NTC10K : -100.0 ~ 100.0°C CA(K) : -100 ~ 100°C	°C	0
400012	000B	A.HI	controlled current max. value	ALO ~ 20mA	mA	20.0
400013	000C	A.LO	controlled current min. value	0.0mA ~ A.HI	mA	4.0
400014	000D	TYP	forward/backward output	0: heater control(forward) / 1: cooling control(backward)		0: heater control(forward)
400015	000E	DIF	output deviation temperature	PT100 / NTC10K : 0.1 ~ 19.9°C CA(K) : 1 ~ 19°C	°C	PT100 / NTC10K : 0.1 CA(K) : 1
400016	000F	DLT	output delay time	0 ~ 1999	sec	0
400017	0010	ALS	alarm output type	0 : AL0 / 1 : AL1		0 : AL0
400018	0011	ADF	alarm output deviation	PT100 / NTC10K : 0.1 ~ 19.9°C CA(K) : 1 ~ 19°C	°C	PT100 / NTC10K : 0.1 CA(K) : 1
400019	0012	HPR	alarm output high limit	PT100 : 400°C CA(K) : LPR ~ 1200°C NTC10K : LPR ~ 99.9°C	°C	PT100 : 400°C CA(K) : 1200°C NTC10K : 99.9°C
			alarm output low limit	PT100 : -200°C ~ LPR CA(K) : -50°C ~ LPR NTC10K : -55.0°C ~ LPR	°C	PT100 : -200°C CA(K) : -50°C NTC10K : -55.0°C
400020	0013	LPR	alarm output low limit	PT100 : T.4 ~ 400°C CA(K) : T.4 ~ 1200°C NTC10K : T.4 ~ 99.9°C	°C	PT100 : 400°C CA(K) : 1200°C NTC10K : 99.9°C
400021	0014	T.20	PV trasmit 20mA temperature	PT100 : -200°C ~ T.20 NTC10K : T.4 ~ 99.9°C	°C	PT100 : -200°C CA(K) : 1200°C NTC10K : 99.9°C
400022	0015	T.4	PV trasmit 4mA temperature	PT100 : -200°C ~ T.20 NTC10K : -55.0°C ~ T.20	°C	PT100 : -200°C CA(K) : -50°C NTC10K : -55.0°C
400023	0016		auto-tuning control	0 : tuning completed, 1 : tuning start		0

< Exception Response > In the product whose sensor error is compensated, a command that is not supported, or when there are other errors, it returns the error information.

Sub products address	Command	Error code	CRC16	Error Code
1BYTE	receiving command + 0x80	1BYTE	low byte	high byte
			low byte	high byte

12 Others

* Sensor extension

- PT100 ohm Sensor: All 3 lines should have the same material and thickness.
- CA(K) : CA(K) should be extended to the sensor wire or compensating cable only
- NTC10K : should extend using 2P shielded cable.
- => Soldering is recommended for the extended area. Poor extension areas may cause a malfunction of the sensor due to inflow of moisture, etc. Be cautious.

* Sensor error display

- o-E** : If the sensor cable has been either cut in the middle, loosen the terminal connection.
- s-E** : When the sensor wires make short each other.
- i-E** : When the temperature sensor for compensation of the cold junction inside the product is in malfunction.

* Memory error display

- E-r** : in case an abnormal data is recorded in the non-volatile memory inside the product or damaged due to severe external noise.

These settings will be changed to the factory default if you press the Set key when this mark **E-r** appears.

- The regulator (controller) has an established counter measure against external noise but the inside may be damaged if noise level is over 2KV.
- Warranty: 1 year from the date of purchase.

- The product specifications are subject to change without notice to improve the performance of the product.
- Regarding the English-language manual, please download it at our homepage.

- H. Office : 56, Ballyongsandan 1-ro, Jangan-eup, Gijang, Busan, Republic of Korea
- Factory : 56, Ballyongsandan 1-ro, Jangan-eup, Gijang, Busan, Republic of Korea

- TEL : +82-51-819-0426
- FAX : +82-51-819-4562
- e-mail : conotec@conotec.co.kr
- URL : www.conotec.co.kr

This Product is suitable in the following environment:
 Ambient temperature : 0°C ~ 60°C
 Ambient humidity : 80%Rh max.
 Rated power : AC 230V 50/60Hz